WHAT IS CLAIMED IS:

[1. A nucleic acid sequence encoding P39.5 or a fragment thereof, isolated from cellular materials with which it is naturally associated.

2. The composition according to claim 1 which is ATCC Accession No. 98478.

3. A nucleic acid sequence encoding P39.5 or a fragment thereof, which is selected from the group consisting of:

(a) SEQ ID NO:1;
(b) SEQ ID NO: 3;
(c) SEQ ID NO: 4;
(d) SEQ ID NO: 5;
(e) SEQ ID NO: 6;
(f) SEQ ID NO: 7;
(g) SEQ ID NO: 8;
(h) SEQ ID NO: 9;
(i) SEQ ID NO: 10;
(j) SEQ ID NO: 11;
(k) SEQ ID NO: 12;
(l) SEQ ID NO: 13;
(m) a sequence which hybridizes to any of (a) through (l) under stringent conditions;
(n) an allelic variant of any of (a) through (m);
(o) a fragment of any of (a) through (m);
(p) a deletion mutant of (a).

4. An isolated P39.5 protein which is expressed *in vitro* by *Borrelia garinii* strain IP90 spirochetes, and has a relative molecular mass of 39,500 daltons.

5. The A recombinant or synthetic protein or peptide that binds with antibodies to the causative agent of Lyme Disease in infected humans or animals, said protein or peptide having at least about 85% identity to, and differing by up to four codon changes in the nucleic acid sequence encoding, the amino acid sequence of a fragment of according to claim 4, comprising an amino acid sequence selected from the group consisting of:

(a) SEQ ID NO: 2 ,

wherein said fragment is at least five amino acids in length and said changes result in up to four conservative amino acid replacements in said amino acid sequence ;

(b) SEQ ID NO: 14;

(c) a fragment of (a) or (b);

(d) an analog of (a) or (b) characterized by having at least 80% homology with SEQ ID NO: 2 or 14; and

(e) a homolog of (a) or (b) characterized by having at least 80% homology with SEQ ID NO: 2 or 14.

6. A recombinant protein selected from the group consisting of:

(a) a protein comprising the amino acid sequence of SEQ ID NO: 2 or 14 or an analog, homolog or fragment thereof;

(b) a fusion protein comprising the amino acid sequence of SEQ ID NO: 2 or 14, or an analog, homolog or fragment thereof fused to a second protein;

(c) a fusion protein comprising the amino acid sequence of SEQ ID NO: 2 or 14 to which are added fragments that are up to 95% identical to SEQ ID NO: 2 or 14;

(d) a deletion protein comprising the amino acid sequence of SEQ ID NO: 2 or 14 with one or more amino acids deleted therefrom.

7. A vector comprising a nucleic acid sequence encoding P39.5 or a fragment thereof under the control of suitable regulatory sequences.

8. A host cell transformed with the vector according to claim 7.

9. A method of recombinantly expressing the P39.5 gene or a fragment thereof comprising the steps of culturing a recombinant host cell transformed with a P39.5 nucleic acid sequence or a fragment thereof under conditions which permit expression of the gene.

10. A method of recombinantly expressing the P39.5 protein or a polypeptide or peptide fragment thereof comprising the steps of culturing a recombinant host cell transformed with a nucleic acid sequence encoding said protein or fragment under conditions which permit expression of said protein or peptide.

11. The method according to claim 10 further comprising the step of isolating said expressed protein from said cell or said cell medium.

12. The method according to claim 10 wherein said P39.5 protein is a fusion protein.

13. The method according to claim 10 wherein said P39.5 protein is a deletion mutant protein.

14. A method for preparing a P39.5 protein or fragment thereof comprising chemically synthesizing said protein or fragment.

15. A diagnostic reagent comprising a nucleic acid sequence selected from the group consisting of:

(a) a nucleic acid sequence encoding P39.5, isolated from cellular materials with which it is naturally associated;

(b) SEQ ID NO:1 or a sequence complementary thereto;

(c) SEQ ID NO: 3 or a sequence complementary thereto;

(d) SEQ ID NO: 4 or a sequence complementary thereto;

(e) SEQ ID NO: 5 or a sequence complementary thereto;

(f) SEQ ID NO: 6 or a sequence complementary thereto;

(g) SEQ ID NO: 7 or a sequence complementary thereto;

(h) SEQ ID NO: 8 or a sequence complementary thereto;

(i) SEQ ID NO: 9 or a sequence complementary thereto;

(j) SEQ ID NO: 10 or a sequence complementary thereto;

(l) SEQ ID NO: 11 or a sequence complementary thereto;

(m) SEQ ID NO: 12 or a sequence complementary thereto;

(n) SEQ ID NO: 13 or a sequence complementary thereto;

(o) a sequence which hybridizes to any of (a) through (n) under stringent conditions;

(p) an allelic variant of any of (a) through (o);

(q) a fragment of any of (a) through (o) comprising at least 15 nucleotides in length;

(r) a deletion mutant of (a), (b) or (n); and

(s) a sequence encoding P39.5 or a fragment thereof fused to a sequence encoding a second protein;

and a detectable label which is associated with said sequence.

16. An isolated antibody which is directed against P39.5 or a fragment thereof.

17. The antibody according to claim 16 produced by administering to a vertebrate host a protein or fragment selected from the group consisting of P39.5, P7-1, P1-1, P3-1, P6-1, P9-1 and P12-1, said antibody capable of killing IP90 spirochetes *in vitro* by antibody-dependent, complement-mediated killing.

18. The antibody according to claim 16, isolated by immunizing said host with the protein of claim 6.

19. The antibody according to claim 16 which is selected from the group consisting of a chimeric antibody, a humanized antibody, a monoclonal antibody and a polyclonal antibody.

20. An antibody isolated by affinity purifying antiserum generated during an infection of rhesus monkeys with JD1 spirochetes using as immunoabsorbant the P39.5 protein of *B. garinii* or a fragment thereof.

21. An anti-idiotype antibody specific for the antibody of claim 16.

22. A diagnostic reagent comprising the antibody according to claim 16 and a detectable label.

23. A vaccine composition comprising an effective amount of a P39.5 protein, fusion protein or fragment thereof and a pharmaceutically acceptable carrier.

24. The composition according to claim 23 wherein said fragment is selected from the group consisting of P7-1, P1-1, P3-1, P6-1, P9-1, and P12-1.

25. The composition according to claim 23 wherein said composition comprises at least one other *B. burgdorferi* antigen or fragment thereof.

26. The composition according to claim 25 wherein said other antigen is selected from the group consisting of OspA, OspB, OspC, BmpA, BmpB, BmpC, BmpD and fragments or variants thereof.

27. The composition according to claim 23 wherein said composition comprises at least one other protein or fragment thereof which has a sequence homologous to that of P39.5 or a fragment thereof.

28. The composition according to claim 23 comprising a mixture of individual proteins.

29. The composition according to claim 25 wherein said P39.5 protein or fragment and said other antigen are in the form of a fusion protein.

30. A method of vaccinating a human or animal against Lyme Disease comprising administering to said human or animal a composition comprising an effective amount of the composition of claim 23.

31. A method for diagnosing Lyme borreliosis in a human or animal comprising the steps of incubating an anti-P7-1 or anti-39.5 antigen or a homolog thereof with a sample of biological fluids from a human or animal to be diagnosed, wherein in the presence of *B. burgdorferi* an antigen-antibody complex is formed, and subsequently analyzing said fluid sample for the presence of said complex.

32. A therapeutic composition useful in treating humans or animals with Lyme disease comprising at least one anti-P39.5 or anti-P7-1 antibody and a suitable pharmaceutical carrier.

33. A method for treating Lyme Disease in a vertebrate host comprising administering an effective amount of a composition according to claim 32.

34. A kit for diagnosing infection with *B. burgdorferi* in a human or animal comprising a P39.5 protein or fragment thereof or an anti-P39.5 antibody of claim 16.

35. A vaccine useful in the prophylaxis of Lyme Disease comprising a surface antigen that is expressed by the spirochete when it resides in the vertebrate host.

36. A method of identifying compounds which specifically bind to P39.5 or a fragment thereof, comprising the steps of contacting said P39.5 protein or fragment with a test compound to permit binding of the test compound to P39.5; and determining the amount of test compound which is bound to P39.5.

37. A compound identified by the method of claim 36.

38. A nucleic acid sequence encoding a protein or a fragment thereof of the *B. garinii* cassette string, isolated from cellular materials with which it is naturally associated, and selected from the group consisting of 1-1, 3-1, 6-1, 9-1 and 12-1.

39. A protein or a fragment thereof of the *B. garinii* cassette string, isolated from cellular materials with which it is naturally associated, and selected from the group consisting of P1-1, P3-1, P6-1, P7-1, P9-1 and P12-1.

40. A vector comprising a nucleic acid sequence encoding a *B. garinii* cassette string protein or fragment thereof under the control of suitable regulatory sequences.

41. A host cell transformed with the vector according to claim 40.

42. A method of recombinantly expressing a *B. garinii* cassette string protein or a fragment thereof comprising the steps of culturing a recombinant host cell transformed with a *B. garinii* cassette string nucleic acid sequence or a fragment thereof under conditions which permit expression of said sequence.

43. A method of recombinantly expressing a *B. garinii* cassette string protein or peptide fragment thereof comprising the steps of culturing a recombinant host cell transformed with a nucleic acid sequence encoding said protein or fragment under conditions which permit expression of said protein or peptide.

44. The method according to claim 43 further comprising the step of isolating said expressed protein from said cell or said cell medium.

45. The method according to claim 43 wherein said *B. garinii* cassette string protein or peptide fragment is a fusion protein or a deletion mutant protein.

46. A method for preparing a *B. garinii* cassette string protein or peptide fragment comprising chemically synthesizing said protein or fragment.

47. An isolated anti-*B. garinii* cassette string protein antibody.

48. The antibody according to claim 47 produced by administering to a vertebrate host a *B. garinii* cassette string protein or fragment.

49. The antibody according to claim 48, isolated by affinity purifying antiserum generated during an infection of rhesus monkeys with JD1 spirochetes using as immunoabsorbant a *B. garinii* cassette string protein.

50. The antibody according to claim 47, isolated by immunizing said host with the protein of claim 39 or a mixture of said cassette string proteins.

51. The antibody according to claim 47 which is selected from the group consisting of a chimeric antibody, a humanized antibody, a monoclonal antibody and a polyclonal antibody.

52. An anti-idiotype antibody specific for the antibody of claim 47.

53. A diagnostic reagent comprising the antibody according to claim 47 and a detectable label.

54. A vaccine composition comprising an effective amount of at least one *B. garinii* cassette string protein, fusion protein or fragment thereof and a pharmaceutically acceptable carrier.

55. The composition according to claim 54 comprising a mixture of different *B. garinii* cassette string proteins or fragments.

56. The composition according to claim 54 comprising at least one other *B. burgdorferi* antigen or fragment thereof.

57. The composition according to claim 56 wherein said other antigen is selected from the group consisting of OspA, OspB, OspC, BmpA, BmpB, BmpC, BmpD and fragments or variants thereof.

58. The composition according to claim 54 comprising P39.5 or at least one other protein or fragment thereof which has a sequence homologous to P39.5.

59. A method of vaccinating a human or animal against Lyme Disease comprising administering to said human or animal a composition comprising an effective amount of the composition of claim 54.

60. A method for diagnosing Lyme borreliosis in a human or animal comprising the steps of incubating an anti-*B. garinii* cassette string protein antibody with a sample of biological fluids from a human or animal to be diagnosed, wherein in the presence of *B. burgdorferi* an antigen-antibody complex is formed, and subsequently analyzing said fluid sample for the presence of said complex.

61. A therapeutic composition useful in treating humans or animals with Lyme disease comprising at least one *B. garinii* cassette string protein antibody, or fragment antibody and a suitable pharmaceutical carrier.

62. A method for treating Lyme Disease in a vertebrate host comprising administering an effective amount of a composition according to claim 61.

63. A kit for diagnosing infection with *B. burgdorferi* in a human or animal comprising a *B. garinii* cassette string protein or fragment thereof or an antibody thereto.

64. A method of identifying compounds which specifically bind to a *B. garinii* cassette string protein or fragment thereof, comprising the steps of contacting said protein or fragment with a test compound to permit binding of the test compound to said *B. garinii* cassette string protein or fragment; and determining the amount of test compound which is bound to said protein or fragment.

65. A compound identified by the method of claim 64.]

1. An isolated, recombinant, or synthetic protein or fragment thereof that binds with antibodies to the causative agent of Lyme Disease in infected humans or animals, wherein said protein is a homolog of a protein having the amino acid sequence formed by reading in frame the sequence of SEQ ID NO: 14 followed by SEQ ID NO: 2, and wherein said fragment comprises at least 5 consecutive amino acids in length of said protein and wherein said protein or fragment has up to four conservative amino acid substitutions at homologous amino acid positions in the amino acid sequence formed by reading in frame the sequence of SEQ ID NO: 14 followed by SEQ ID NO: 2 or fragments thereof.

2. The protein according to claim 1, wherein said protein is expressed by spirochetes of a *B. burgdorferi sensu lato* strain.

3. The protein or fragment according to claim 1, having at least 50% identity with a protein having the amino acid sequence formed by reading in frame the sequence of SEQ ID NO: 14 followed by SEQ ID NO: 2.

4. The protein or fragment according to claim 1, having at least 85% identity with a protein having the amino acid sequence formed by reading in frame the sequence of SEQ ID NO: 14 followed by SEQ ID NO: 2.

5. The protein or fragment according to claim 1, wherein said fragment is at least eight amino acids in length.

6. The protein or fragment according to claim 1, wherein said protein or fragment is coupled to a substrate that immobilizes said protein or fragment.

7. The protein or fragment according to claim 1, wherein said protein or peptide is coupled to a detectable label or signal-generating reagent.

8 A kit for diagnosing infection with a causative agent of Lyme Disease in a human or animal comprising a protein or fragment of claim 1, and at least one of the group consisting of a substrate that immobilizes said protein or peptide, a detectable label, a labeled conjugate, and a signal generating reagent

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